

CLAIMS

What is claimed is:

5 1. A fuel cell for generating an electric current by combining hydrogen and oxygen wherein resistance to the flow of electric current through the cell is non-uniform over the areal extent of the cell to regulate the flow of oxygen ions through any region of said cell in proportion to the partial pressure of hydrogen in said region.

 2. A fuel cell in accordance with Claim 1, further comprising:

10 a) an anode for reacting hydrogen ions with oxygen ions, said hydrogen ions being derived from gaseous molecular hydrogen flowing in a first flow path through a first portion of said cell with oxygen ions;

 b) a cathode for providing said oxygen ions derived from gaseous molecular oxygen flowing in a second flow path through a second portion of said cell; and

15 c) a solid oxide electrolyte separating said anode from said cathode, wherein said electrical resistance is areally non-uniform over one of said anode, cathode, and electrolyte.

 3. A fuel cell in accordance with Claim 2 wherein said fuel cell is one of a plurality of such fuel cells in a fuel cell stack, said stack including interconnects between
20 said fuel cells and current collectors, wherein said electrical resistance is areally non-uniform over one of said interconnects and said current collectors.

4. A fuel cell in accordance with Claim 2 comprising a layer of dielectric material having a graded thickness for providing maximum electrical resistance in the thickest areas of said layer and minimum electrical resistance in the thinnest areas of said layer.

5 5. A fuel cell in accordance with Claim 3 further comprising conductive filaments for conducting electric current between an electrode and a current collector, said cell comprising a non-uniform pattern of dielectric material disposed on at least one of said anode, cathode, interconnect, and current collector for varying the areal contact density of said filaments with said pattern-bearing element.

10 6. A fuel cell in accordance with Claim 3 further comprising conductive filaments for conducting electric current between an electrode and a current collector, wherein said filaments are arranged in a non-uniform pattern to vary the areal contact density of said filaments therebetween.

15 7. A fuel cell in accordance with Claim 3 wherein at least one of said interconnects and current collectors is provided with a non-uniform pattern of protrusions extending above the surface of said interconnect or current collector to make contact with at least one of said anodes and cathodes to form a non-uniform pattern of conductivity over the areal extent of said cell and an inverse non-uniform pattern of resistivity.

20 8. A fuel cell in accordance with Claim 2 wherein said anode is formed in an areally non-uniform pattern of chemical composition.

9. A fuel cell in accordance with Claim 8 wherein said pattern is formed of conductive and dielectric materials, said conductive material being nickel and said dielectric material being yttria stabilized zirconia.

10. A fuel cell in accordance with Claim 2 wherein said cathode is formed in an areally non-uniform pattern of chemical composition.

11. A fuel cell in accordance with Claim 10 where in said cathode comprises lanthanum strontium manganate and the atomic proportion of lanthanum to strontium across the cathode is varied non-uniformly to vary the conductivity across the cathode.

12. A fuel cell in accordance with Claim 10 where in said cathode comprises lanthanum strontium iron and the atomic proportion of lanthanum to strontium across the cathode is varied non-uniformly to vary the conductivity across the cathode.

13. A fuel cell in accordance with Claim 2 wherein the porosity of said cathode is varied non-uniformly across the cathode to vary the concentration of oxygen passing through the cathode.

14. A fuel cell in accordance with Claim 2 wherein the thickness of said electrolyte is varied, non-uniformly to provide greater electrical resistance in the thicker areas and lesser electrical resistance in the thinner areas.

15. An automotive vehicle including a fuel cell for combining oxygen and hydrogen to generate an electric current, wherein resistance to the flow of electric current through said cell is non-uniform over the areal extent of said cell to regulate the

- 15 flow of oxygen ions through any region of said cell in proportion to the partial pressure of hydrogen in said region.